

# Hand hygiene and infection control survey pre- and peri-H1N1-2009 pandemic: knowledge and perceptions of final year medical students in Singapore

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## ABSTRACT

**Introduction:** Infection control and hand hygiene are taught at different points in the undergraduate medical curriculum. We conducted a survey on fifth year medical (M5) students pre- and peri-influenza A (H1N1-2009) pandemic, attempting to ascertain whether the pandemic had affected their knowledge, perception and practice of hand hygiene and other aspects of infection control.

**Methods:** A self-administered anonymous survey of M5 students was performed between August 2008 and February 2010, corresponding to two successive classes: M5-2008 (Class of 2004/09) and M5-2009 (Class of 2005/10). Completed survey forms were collated and analysed centrally.

**Results:** There were 191 and 123 respondents for M5-2008 and M5-2009, respectively, corresponding to 74.9% and 47.3% of the respective classes. More M5-2009 respondents recognised alcohol hand rub as the preferred mode of hand hygiene practice and felt that there were insufficient isolation facilities in hospitals. Otherwise, survey responses were consistent. The majority felt that few doctors practiced hand hygiene appropriately, with the major obstructing factor being lack of time during ward rounds. The most important factor for improving hand hygiene compliance among junior doctors and students was for senior clinicians to lead by example. A significant minority believed that it was necessary to isolate patients with chikungunya, malaria or HIV.

**Conclusion:** The 2009 H1N1 pandemic made little impact on medical students' knowledge and practice of infection control. Nonetheless, their responses have suggested avenues for improving infection control practice, including persuading

senior clinicians to lead by example in hand hygiene practice and addressing gaps in knowledge on patient isolation policies.

**Keywords:** hand hygiene, infection control, influenza pandemic, medical education, survey

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## INTRODUCTION

Healthcare-associated infections (HAIs) are major causes of morbidity and mortality, contributing significantly to excess hospital deaths, length of stay and costs.<sup>(1,3)</sup> Although studies suggest that up to 80% of HAIs may be inevitable,<sup>(4,5)</sup> there is an emerging consensus that systemic and individual failures account for a significant proportion of HAIs, and that these are preventable (or can at least be minimised) if appropriate interventions are implemented successfully.<sup>(4,6)</sup> Indeed, in some developed countries, "getting to zero" HAIs is a recognised target and an emerging policy framework.<sup>(7)</sup>

In Singaporean hospitals, efforts at preventing HAIs have centred on improving infection control measures, in particular, hand hygiene compliance among healthcare staff. The Ministry of Health, Singapore has publicly signed onto the World Health Organization's "Clean Care is Safer Care" pledge of the first global patient safety challenge.<sup>(8)</sup> Various hospitals have launched hand hygiene campaigns over the past few years,<sup>(9,10)</sup> or made hand hygiene a hospital-wide clinical performance indicator.<sup>(11)</sup>

At the local undergraduate medical school, HAIs, infection control and hand hygiene are formally taught at different points in the curriculum. Medical students are introduced to infection control and hand hygiene during their second year (M2) Clinical Microbiology and Infection and Clinical Skills Foundation courses, and infection control is revisited during their infectious diseases clinical posting in the fifth year (M5). During their clinical years, as part of their training, medical students are exposed to various hospital infection control practices as well as to patients who develop HAIs.

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We had begun a survey on M5 students in the second half of 2008 (corresponding to the 2008/2009 academic year) so as to determine their knowledge, perception and practice of hand hygiene and other aspects of infection control prior to graduation. When the influenza A (H1N1) pandemic occurred in 2009, a variety of preplanned pandemic control strategies were implemented in Singapore, including heightened infection control practices in hospitals.<sup>(12)</sup> Medical students were directly affected when all clinical rotations were cancelled during the initial months of the pandemic.<sup>(13)</sup> Given the enhanced focus on infection control and the direct personal impact of the pandemic on the students, we continued the survey on the subsequent batch of M5 students (2009/2010 academic year) in order to ascertain whether the influenza pandemic had affected their knowledge, perception and practice of infection control. In the preceding SARS epidemic, healthcare workers had demonstrated better compliance to hand hygiene and other infection control practices.<sup>(14)</sup>

## METHODS

A self-administered written survey (supplementary information) of M5 students was conducted between August 1, 2008 and February 28, 2010, corresponding to two successive M5 classes: M5-2008 (Class of 2004/09) and M5-2009 (Class of 2005/10) (August 2008 to February 2009 for M5-2008 and August 2009 to February 2010 for M5-2009). Survey forms were distributed prior to the lecture on infection control during their fortnight-long infectious diseases postings at the Communicable Disease Centre. Students were not compelled to participate in the survey in any way, and no identifying information was obtained from the respondents. Completed survey forms were collected by the lecturer and placed in a response box, where they were collated and the responses coded by data entry staff.

Intercooled Stata 11.1 (StataCorp, College Station, TX USA) was used for all statistical calculations. Categorical variables were analysed via contingency tables with chi-square test or Fisher's exact test appropriately, with all tests conducted at the 5% level of significance.

## RESULTS

There were 191 respondents for M5-2008 and 123 respondents for M5-2009, corresponding to 74.9% and 47.3% of the respective classes. All had been posted as part of their clinical rotations to at least four public sector hospitals; the majority (68.8% and 69.1% of M5-2008 and M5-2009, respectively) had been to all six hospitals during their clinical years.

The cumulative response to each survey question is displayed in Table I. From the table, compared with M5-2008 respondents, significantly more M5-2009 respondents recognised alcohol hand rub as the preferred mode of hand hygiene practice and felt that there were insufficient isolation facilities in local hospitals. Significantly fewer felt that patients with extrapulmonary tuberculosis or methicillin-resistant *Staphylococcus aureus* (MRSA) bacteraemia should be isolated.

Otherwise, the survey responses were comparable across both years. The majority felt that most doctors practiced hand hygiene after each patient contact, but few did so both before and after patient contact. More than 40% of students were unable to comment on the hand hygiene practices of nurses, and the major factor preventing hand hygiene compliance among all healthcare staff was felt to be a lack of time during ward rounds. The majority believed that hand hygiene was adequately taught in medical school, but the single most important factor for improving hand hygiene compliance among junior doctors and students was for senior clinicians to lead by example. More students felt that it was important to isolate patients with MRSA infections rather than those who were merely colonised, and a significant minority believed that it was necessary to isolate patients with infections such as chikungunya, malaria or HIV.

59 (30.9%) M5-2008 and 38 (30.9%) M5-2009 students provided freeform comments for improving infection control in hospitals. The necessity of senior clinicians leading by example was emphasised again in 16.9% and 31.6% of M5-2008 and M5-2009 responses, respectively. More M5-2008 students (44.1% vs. 5.3%) suggested that the practice of wearing lab coats among students be discontinued, whereas 21.1% of M5-2009 freeform respondents stressed the importance of financial incentives.

## DISCUSSION

The results of the survey highlighted several points of interest. Strikingly, there was little difference in infection control knowledge, perception and practices of final year medical students pre- and peri-H1N1(2009) pandemic. It is possible that infection control education and practices directed against a droplet-borne pandemic agent such as the influenza A (H1N1-2009) virus were too specific, and thus, precluded students developing a broader understanding of other infection control issues. Nonetheless, perhaps experiencing the pandemic during their clinical rotations resulted in more M5-

**Table I. Responses to the 5th year medical student infection control survey questions.**

Survey question	No. (%)	
	M5-2008 (n = 191)	M5-2009 (n = 123)
Optimum mode of hand hygiene practice*		
Soap and water	39 (20.4)	18 (14.6)
Alcohol hand rub	55 (28.8)	60 (48.8)
Chlorhexidine and water	25 (13.1)	11 (8.9)
Hibiscrub and water	72 (37.7)	34 (27.6)
Personal hand hygiene		
Before and after each patient contact	45 (23.6)	40 (32.5)
After each patient contact	114 (59.7)	64 (52.0)
Before each patient contact	1 (0.5)	5 (4.1)
Occasionally omit hand hygiene	30 (15.7)	13 (10.6)
Usually omit hand hygiene	1 (0.5)	1 (0.8)
Always omit hand hygiene	0 (0)	
Observation of doctors		
Majority practice hand hygiene before and after each patient contact.	11 (5.8)	15 (12.2)
Majority practice hand hygiene after each patient contact.	137 (71.7)	82 (66.7)
Majority practice hand hygiene before each patient contact.	3 (1.6)	3 (2.4)
Majority do not practice hand hygiene.	36 (18.9)	20 (16.3)
Unable to comment.	4 (2.1)	3 (2.4)
Observation of nurses		
Majority practice hand hygiene before and after each patient contact.	36 (18.9)	26 (21.1)
Majority practice hand hygiene after each patient contact.	50 (26.2)	29 (23.6)
Majority practice hand hygiene before each patient contact.	2 (1.1)	4 (3.3)
Majority do not practice hand hygiene.	13 (6.8)	9 (7.3)
Unable to comment.	90 (47.1)	55 (44.7)
Factors preventing hand hygiene compliance among healthcare staff †		
Lack of time	151 (64.8)	96 (60.4)
Lack of education	3 (1.3)	3 (1.9)
Failure to recognise its importance	49 (21.0)	32 (20.1)
Peer pressure (senior staff do not practice hand hygiene)	15 (6.4)	16 (10.1)
Others	15 (6.4)	12 (7.5)
Hand hygiene teaching in medical school		
Not taught	0 (0)	
Taught but no impression otherwise	1 (0.5)	2 (1.6)
Poorly taught	8 (4.2)	4 (3.3)
Average teaching	51 (26.8)	30 (24.6)
Well taught but could be improved	69 (36.3)	42 (34.4)
Excellent teaching	61 (32.1)	44 (36.1)
Measures that may improve hand hygiene compliance among students and junior doctors ††		
Improve undergraduate education efforts	33 (9.6)	19 (8.3)
Top administrative staff support and emphasis	18 (5.3)	10 (4.4)
Incorporate into exam and student internship marking scheme	25 (7.3)	25 (10.9)
Senior clinicians to lead by example	140 (40.9)	86 (37.6)
Improve public awareness – patients monitoring doctors	28 (8.2)	17 (7.4)
Positive incentives for hand hygiene	68 (19.9)	43 (18.8)
Better policing by infection control staff	22 (6.4)	22 (9.6)
Others	8 (2.3)	7 (3.1)
Most important step towards improving hand hygiene compliance among students and junior doctors††		
Improve undergraduate education efforts	11 (5.9)	8 (6.5)
Top administrative staff support and emphasis	3 (1.6)	3 (2.4)
Incorporate into examination and student internship marking scheme	5 (2.7)	9 (7.3)
Senior clinicians to lead by example	120 (63.8)	69 (56.1)
Improve public awareness – patients monitoring doctors	14 (7.5)	4 (3.3)
Positive incentives for hand hygiene	25 (13.3)	22 (17.9)
Better policing by infection control staff	7 (3.7)	3 (2.4)
Others	3 (1.6)	5 (4.1)
Groups of inpatients that should be isolated		
MRSA colonisation but not infection	99 (51.6)	57 (46.3)
MRSA pneumonia	172 (89.6)	108 (87.8)
MRSA wound infection	142 (74.0)	85 (69.1)
MRSA bacteraemia*	157 (81.8)	86 (69.9)
VRE colonisation	150 (78.1)	97 (78.9)
Multidrug-resistant <i>Acinetobacter baumannii</i> infection	123 (64.1)	87 (70.7)
<i>Clostridium difficile</i> colitis	61 (31.8)	32 (26.0)
Pulmonary tuberculosis	174 (90.6)	115 (93.5)
Extrapulmonary tuberculosis*	76 (39.6)	33 (26.8)
Chikungunya	45 (23.4)	18 (14.6)
Malaria	39 (20.3)	19 (15.5)
Human immunodeficiency virus infection	33 (17.2)	13 (10.6)
Community-acquired pneumonia	24 (12.5)	12 (9.8)
Sufficient isolation facilities in Singaporean hospitals#	95 (66.0)	37 (46.3)

\* Statistically significant at  $p < 0.05$ .

†The respondents could select multiple options for these questions.

††188 and 123 valid answers from M5-2008 and M5-2009 students, respectively.

#144 and 80 valid answers from the classes of 2008 and 2009, respectively.

MRSA: methicillin-resistant *Staphylococcus aureus*; VRE: vancomycin-resistant enterococci

2009 respondents having the opinion that there were insufficient isolation facilities in local hospitals, as the local policies mandated isolation and quarantine, especially early in the pandemic.

One other area of difference was in the optimum mode of hand hygiene, with more students in the class of 2009 selecting alcohol hand rub, but this may well be a function of more hospitals providing alcohol hand rub peri-pandemic (particularly at the patient bedside) than any effect of education. A significant proportion of students selected 'hibiscrub (a combination of 4% chlorhexidine gluconate with 4% isopropyl alcohol) and water, which is still found above most ward sinks in local hospitals.

Among a variety of interventions recommended for improving compliance to hand hygiene,<sup>(15)</sup> the majority of students selected 'senior clinicians leading by example' as the most important intervention toward improving compliance among junior doctors and students. This is credible given the hierarchical nature of medical and surgical practice, where the actions and opinions of respected consultants/senior consultants strongly influence practice among their junior staff. It is also widely documented in the hand hygiene literature that role models play an important part in increasing hand hygiene compliance.<sup>(16)</sup>

Responses on isolation of inpatients with various infections demonstrated that more efforts on undergraduate education are necessary. MRSA-colonised patients are believed to be equally likely to be reservoirs for transmission of the bacterium as those with overt infections, and therefore, isolation or cohorting is recommended for such patients.<sup>(17)</sup> Current guidelines also recommend isolation of patients with *Clostridium difficile* disease so as to prevent transmission.<sup>(18)</sup> Isolation of patients with extrapulmonary tuberculosis, which is not contagious, or chikungunya and malaria, which are vector-borne, or HIV infection, which is blood-borne and sexually transmitted, is unnecessary.

This survey has several limitations. Firstly, we were not able to survey all students, and the proportion who responded in the class of 2009 was far lower compared with the previous year. As students were not asked for their reasons for declining the survey, the cause of the lower response rate is unknown, although it is possible that this might be the result of "survey fatigue", as a number of knowledge, attitude and practice surveys were being conducted at the same time. Secondly, the questions posed were broad in scope but limited in depth – as an example, it is not possible to fathom why the students chose to isolate patients with certain infections

but not others. Thirdly, there was an inherent recall bias in surveying the hand hygiene practices of doctors and nurses. The students' response was that less than 25% of doctors and nurses cleaned their hands before and after each patient contact, a result that is far lower than local published hand hygiene audits.<sup>(11)</sup> However, the latter may also not reflect the true prevalence of appropriate hand hygiene practice due to the Hawthorne effect. Lastly, a pre- and post-pandemic survey on the same group of respondents (i.e. M5-2008) may be more reflective of the impact of the pandemic on infection control knowledge and practices, although that might also reflect another year of clinical training. Unfortunately, this was not feasible given the practicalities of manpower and time at that point.

In conclusion, we found that the 2009 H1N1 pandemic appeared to have made little impact on medical students' knowledge and practice of infection control. Nonetheless, their responses have suggested avenues for improving infection control practice, including persuading senior clinicians to lead by example in hand hygiene practice, and addressing gaps in knowledge on patient isolation policies.

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